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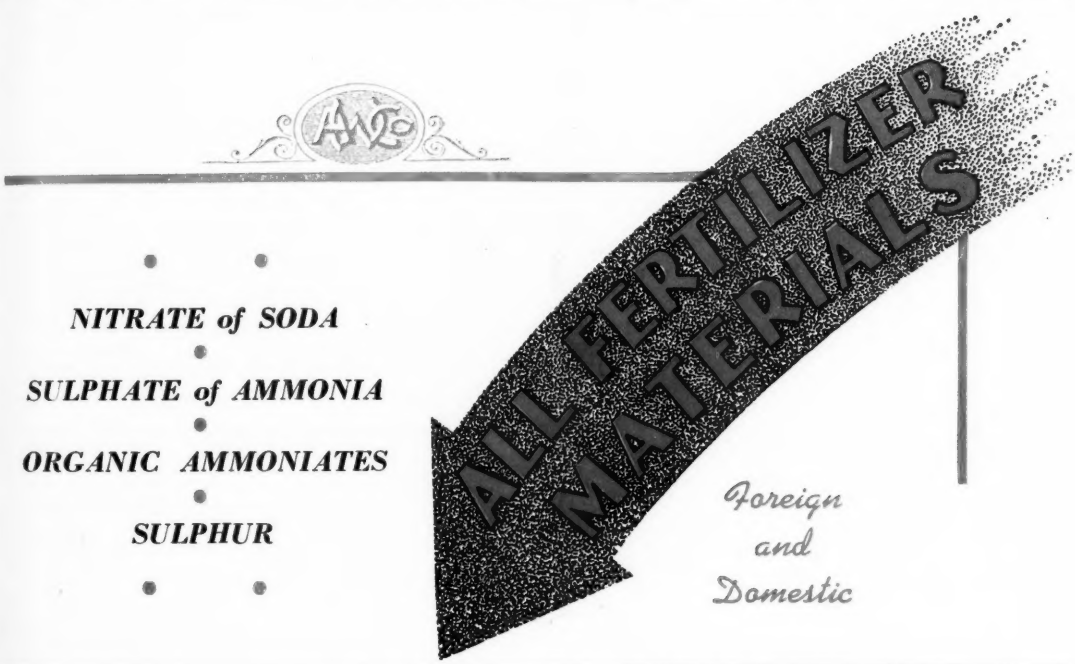

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AMERICAN FERTILIZER

"That man is a benefactor to his race who makes two blades of grass to grow where but one grew before."

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Interview on Mr. Brand's South American Trip

By JESSIE FANT EVANS

The Evening Star, Washington, D. C.

CHARLES J. BRAND, internationally known agricultural economist and plant-food specialist, has just returned from a 15,000-mile plane trip to Brazil, Argentina, Chile and Peru. He strongly believes that tremendous mutually advantageous agricultural and industrial relationships can be developed with our South American neighbors.

"These relationships can best be developed." he says, "by working out a non-competitive economy that will take advantage of complementary rather than conflicting interests between the two great continents of the Western Hemisphere." Mr. Brand is executive secretary and treasurer of the National Fertilizer Association, with headquarters in Washington, and speaks as a business executive as well as an economist and a scientist. He is confident that business possibilities of a complementary type are far greater than is generally realized. Pan-American planning for the post-war period should be based largely upon proverbial American common-sense methods of fair play based upon proven business principles, rather than too much upon theoretical, idealistic procedures. "Without a foundation of sound business in conjunction with practical idealism," he warns, "inevitable disappointments and even business collapse may result on both sides in all too many instances."

The purpose of Mr. Brand's trip to South America was a combined economic and scientific one, coupled with an interesting academic mission. At the invitation of Senor Rodolfo Michels, Ambassador from Chile to the United States, he went as a delegate from his association to the postponed South American Congress of Chemistry in Santiago, Chile. Upon behalf of the George Washington University and its president, Dr. Cloyd Heck Marvin, and the University of Minnesota and its president, Dr. W. C. Coffey, Mr. Brand extended greetings to the University of Chile, of which Dr. Juvenal Hernandez is president, on the celebration of its 100th anniversary. He was the luncheon guest of the University authorities, and afterwards addressed a large open meeting of its faculties and alumni. He also bore greetings to Monsignor Carlos Casanueva, rector of the Catholic University of Chile.

Asked to enlarge upon his ideas in connection with a non-competitive trade economy between the Americas, Mr. Brand said: "The sensible thing as to our South American neighbors is for the United States to draw upon them for the things they can produce and we cannot. We, on the other hand, can furnish the industrial products which they are not as yet equipped to manufacture. However, South America never should be kept from sensible self-industrialism, nor do I believe there is the slightest desire on the part of the United States to exercise such a restraint, now or in the future."

As examples of the policy he has in mind, he cited Brazil's export of coffee to the United States. Brazil grows 69 per cent of the coffee of the world. We do not grow a single pound of coffee. He also referred to Brazil as the home of the most valuable of all species of rubber, *Hevea brazilensis*. He believes that Brazil's cultivation of her natural rubber with a subsidy from the United States, and our subsidizing of a synthetic rubber in our own country, need not necessarily conflict even in a peace-time world.

Brazil is as large as the United States with another Texas added. Mr. Brand considers it a land of tremendous economic possibilities, but facing enormous social and political problems, largely as the result of racial mixtures.

In Brazil he visited the experiment station near Rio de Janeiro, and also the cotton breeding and seed distribution station at Campinas. Brazil is the largest cotton-exporting country in the world next to the United States. In the country around Rio, he observed the present unwise practice of ignoring land contour in planting citrus groves. Already erosion has completely destroyed 100,000,000 acres of land in our own country, and threatens a further destruction equally as great. Agricultural leaders in Brazil, he was told, realize the danger but find it difficult to get the political authorities to do anything about it. Excellent progress is being made in the use of superphosphate in some sections.

Argentina

Argentina, in Mr. Brand's opinion, is more definitely competitive than any of the other countries in its trade relationships with the United States. But even with Argentina, he thinks there is hope of reasonable post-war trade arrangements. Some of the finest beef in the world is produced in Argentina. In this time of stringent meat shortages at home, he certainly makes one's mouth water by describing the delicious three-finger deep steaks, bigger than a man's hand, for sale at very reasonable prices in all of Argentina's restaurants.

Mr. Brand considers Argentina's failure thus far to join the United Nations a somewhat natural outcome of a century of competition between European nations for her favor. He is sorry to say that he believes this often has been aimed at deprecating the fundamental friendliness between North and South America. We on our part, while always friendly at heart, have certainly not always been entirely wise or tactful in out attitudes. The very difficulty of working our atsisfactory trade relations, Mr. Brand feels, should be a challenge to the business and political statesmanship of both Argentina and the United States.

Mr. Brand visited the experiment station near Pergamino, and numerous large estancias; also a first generation corn-breeding farm in which Vice-President Wallace has taken an interest. Fertilizer use is in its infancy in Argentina but there is ample evidence that it can be used advantageously.

Chile, Mr. Brand states, is perhaps the friendliest of the four South American countries which he visited, and is perhaps more like the United States than any other country except Argentina. Both, he feels, should be among our best friends, nationally. Senor Michels, who has been Ambassador from Chile to the United States for a number of years, he points out, is one of the finest emissaries his country and ours could possibly have in promoting friendship and good neighborly relations.

Luncheon With the President of Chile

It was Mr. Brand's good fortune to have a very pleasant visit with the President of Chile, Senor Juan Antonio Rios, on the day Minister of the Interior Morales reported on his conferences in the United States which led to Chile's joining the United Nations in the war. Earlier in the day, Mr. Brand was honored at a luncheon with Senor Don Guillermo del Pedegral, Minister of Hacienda and President de la Corporacion de Ventas de Salitre y Yodo presiding. This luncheon was also attended by General Frolian Arriagada, the Minister of Economics and Commerce, Hon. Claude Bowers, the American Ambassador, and many men prominent in the public and business life of Chile, including Senor Don Jorge Vidal, vice-president of the Chilean nitrate corporation.

During his two weeks' stay in Chile, Mr. Brand visited the fine agricultural areas south and northwest of Santiago, particularly the fruit, livestock and hemp-growing activities in the regions around Los Andes. He also spent four days on the nitrate pampas north and east of Antofagasta. Chile has made a tremendously valuable contribution to the economy of the world through its great natural nitrate industry and its big copper mines, two of which are owned by American interests. For nearly a century Chile supplied by far the largest part of the nitrate used for plantfood in the world. Now again, with the tremendous need for food in wartime, Chilean nitrate will be a tremendously important supplement to the by-product nitrogen obtained here in the United States from the coking of coal for the steel industry and from our highly valuable and efficient synthetic nitrogen plants.

In conclusion, Mr. Brand, who has a working knowledge of Spanish, expressed the hope that every school child in North America in the future may learn at least one additional language, namely Spanish, and that every pupil in every South American school may learn English. "Language barriers," he

(Continued on page 22)

Limited Amount of Cottonseed Meal Available for Fertilizer

There has recently been issued Food Production Order 8. Oilseed Meal, which supersedes Commodity Credit Corporation Oilseed Order 7 except as to violations committed or rights or liabilities incurred prior to the effective date of FPO 8, February 10, 1943. The new order will be administered by the Director of Food Production, U. S. D. A.

FPO 8 in general continues the restrictions contained in Oilseed Order 7 as to the purchase and sale of oilseed meals for use in the manufacture of mixed fertilizer for sale, but contains two exceptions:

(1) Cottonseed meal or cake may be used for the manufacture of mixed fertilizer for sale: (a) if acquired from a farmer who acquired it before January 2, 1943, and (b) if the organic nitrogen content thereof, together with the total quantity of organic nitrogen otherwise acquired prior to the date of such acquisition for use during 1942–43, in the manufacture of mixed fertilizer for sale, does not exceed 80 per cent of the quantity of organic nitrogen used for such purpose in 1941–42. It would seem now to be permissible for a fertilizer manufacturer to exchange fertilizer for cottonseed meal (acquired by the farmer before January 2nd); to use it, subject to the 80 per cent organic nitrogen limitation, in manufacturing mixed fertilizer for sale; and to sell any excess for the feeding of livestock or to some other manufacturer for use in making mixed fertilizer for sale. The order contains no limitation as to crop use of mixed fertilizer containing cottonseed meal acquired under this exception.

(2) Cottonseed meal or cake acquired with the approval of the Director of the Food Production Administration may be used in manufacturing mixed fertilizer for sale for use only on citrus fruits, cigar leaf tobacco, and the Group A vegetable crops. U. S. D. A. has announced that allocations of cottonseed meal under this exception will be made on the basis of information obtained directly from fertilizer manufacturers, and after taking into consideration: (1) the units of organic nitrogen in materials used in mixed fertilizer for the 1941–42 season; (2) the quantity of organic nitrogen which has been available for such fertilizers for the present season up to January 11th; (3) the quantity of organic nitrogen the fertilizer mixer has on hand or under contract to be used in mixed fertilizer up to June 30, 1943; (4) the estimated minimum requirements of cottonseed meal needed, by months, in the production of citrus fruits, cigar leaf tobacco, and "A" vegetable crops.

Persons who have contracts for the delivery of oilseed meal which they are unable to deliver because of the prohibitions of the order are specifically authorized promptly to offer such oilseed meal for sale to feeders, feed dealers, or feed manufacturers for feeding poultry and livestock.

Any person affected by the order who considers that compliance with the order would work an exceptional and unreasonable hardship on him may apply to the Director for relief, setting forth the pertinent facts and information and the nature of the relief sought.

Communications concerning the order should be addressed to The United States Department of Agriculture, Food Production Administration, Washington, D. C., Ref. FPA 8.

Meeting of Fertilizer Industry Advisory Committee

The Fertilizer Industry Advisory Committee held a meeting at the Conference Room, Agriculture Administration Building, on Wednesday, February 10th. Presiding: David Meeker, U. S. D. A. Also present: M. Clifford Townsend, director, Food Production Administration; Sherman Johnson, W. A. Lafkin, William F. Watkins, L. G. Porter, W. M. Belser, J. E. Nunnally, J. P. F. Ritz, George Worman, F. W. Parker, K. G. Clark, C. C. Farrington, U. S. D. A.; Dale C. Kiefer, Herbert H. Meyers, Sheldon Clement, WPB; J. K. Westberg, C. G. Gran, H. J. Cordle, Roland Payne, OPA; Lt. E. Gallahue, Army-Navy Munitions Board; Major H. B. Musser, Headquarters Army Air Forces. The following industry representatives were invited: J. A. Woods, L. H. Carter, S. B. Haskell, C. F. Hockley, Horace Albright, John E. Sanford, John A. Miller, Weller Noble, C. D. Shallenberger, Oscar F. Smith, George Cushman, W. B. Tilghman, M. H. Lockwood, M. K. Derrick, T. E. Milliman, F. J. Woods, Franklin Farley, N. E. Harman, and Charles J. Brand. Messrs. Carter, Milliman, and Noble were absent. Also, F. T. Techter, M. H. McCord, R. B. Douglass, and John L. Morris substituted for

Messrs. Haskell, Hockley, Smith, and Tilghman, respectively.

FPA Director Townsend discussed the question of fertilizer supplies and distribution. He stated that he believes the present fertilizer distribution procedure will get the required results without resort to full rationing. However, if such rationing becomes necessary, it will be done. He thanked the industry and the National Fertilizer Association for their cooperation. Mr. Meeker pointed out the necessity for dissemination of information to all concerned in the fertilizer situation and urged that manufacturers bring all the facts to the attention of dealers, who are the chief channel of information to the farmer. Mr. Johnson spoke of the production goals and the necessity for increasing production of the war crops, and of fertilizer's part in promoting such production. Mr. Watkins and Mr. Lafkin discussed the provisions and administration of Food Production Order 5.

Other matters discussed by Government officials and industry representatives included labor shortage in fertilizer plants, victory gardens, FPO 8 (the new oilseed meal order), and gasoline supplies. OPA officials reported that a revision of MPR 108 is in process of preparation, as is an amendment to MPR 135 to provide for maximum prices for Victory Garden Fertilizer formulated otherwise than with one-half unit of chemical nitrogen and 2½ units of organic nitrogen. WPB officials reported that a potash conservation order is being prepared, and discussed the objectives of allocation of materials in relation to the supply situation.

The next meeting of the Committee is to be held on Wednesday, March 10th. It is planned to have four subcommittees as follows: chemical nitrogen; organic nitrogen; superphosphate; potash including mixed fertilizer representation.

Georgia Fertilizer Amendment

House Bill 428 proposes to amend the fertilizer control law by providing that all fertilizer tax tags have consecutive numerical serial numbers and requiring manufacturers "to file with the Commissioner of Agriculture at the end of the fiscal year a statement under oath of all fertilizer sold and all tags bought, setting forth fees and the last serial number." The bill has been favorably reported by the House Agricultural Committee and placed on a second reading.

Suggestions for the Use of the War Grades of Fertilizer in Texas

G. S. Fraps, Chief of the Division of Chemistry, Texas Agricultural Experiment Station, has issued a circular giving recommendations for the use of the war grades of fertilizers on various crops. While the suggestions are made for Texas crops only, they form an interesting comparison with grades and amounts used in other states.

Cotton

For cotton 200 to 400 pounds per acre of a 3–12–6 fertilizer is recommended in those areas of the state where fertilizers are used on this crop, particularly on the sandy soils in eastern Texas. In general cotton needs more nitrogen than is indicated by this grade, and the addition by the farmer of cottonseed meal (100 to 200 pounds) or other organic nitrogenous material available, to be equivalent to a 6–12–6 fertilizer would make a better balanced fertilizer for cotton. In the Gulf Coast Prairie 200 to 300 pounds of 3–15–0 per acre is recommended.

Corn

The use of 200 to 300 pounds of a 3–12–6 fertilizer per acre is suggested for corn. Usually corn requires a higher proportion of nitrogen and the addition of cottonseed meal or peanut meal (about 100 pounds per acre) by the farmer to make a 6–12–6 fertilizer should be more satisfactory.

Grain Sorghum

Where these sorghums are grown in the eastern part of the state, the fertilizer recommendations for corn should be applicable to grain sorghums.

Rice

The application of 200 to 300 pounds per acre of 3–15–0 is recommended for rice which is grown only in Gulf Coast Prairie from the Sabine River to the Guadalupe River. About 200 pounds of 0–14–7 may also be used but the results of fertilizer experiments in Texas show that the rice soils are more in need of nitrogen and phosphate than potash.

Peanuts

For peanuts, 100 to 200 pounds per acre of 0–14–7, or 3–12–6, or 20 percent superphosphate or its equivalent is suggested in the main peanut-growing areas of the state, as in east Texas, in the West Cross Timbers, and in the San Antonio area. Unless the soil

is known to be inoculated with the proper bacteria, the peanuts should be inoculated to insure adequate nodulation so the peanuts will be able to get the necessary nitrogen from the air.

Sugar Cane for Syrup

The application of 300 to 500 pounds per acre of 4–12–4 or 3–15–0 is recommended for sugar cane, which is grown mainly on the alluvial soils along the streams in eastern and northeastern Texas. Where these fertilizers are used the application of 100 to 200 pounds per acre of cottonseed meal, or other organic nitrogen material as a mixture with the fertilizer or as a side dressing is also recommended. Two to three hundred pounds of 10–10–0 fertilizer per acre also should be satisfactory.

Sweet Sorghums for Sirup

For this crop the use of 200–400 pounds per acre of a 4–12–4 fertilizer is recommended in the eastern part of the state.

Sudan Grass and Other Forage Sorghums

Where these crops are grown on sandy soils in those parts of the state having 30 inches or more of rainfall a year, which is roughly in the eastern half of the state, 200 to 300 pounds of a 3–12–6 fertilizer per acre is suggested.

Alfalfa

Alfalfa is grown mostly on alluvial soils in all parts of the state and on irrigated soils in the western part of the state. On soils that have been in cultivation for a considerable time, 200 to 300 pounds per acre of 20 per cent superphosphate is recommended. On lighter soils and soils that have been in cultivation many years, 300 to 400 pounds of an 0–14–7 fertilizer may give better results.

Winter-growing Legumes

The application of 100 to 200 pounds per acre of 20 per cent superphosphate is recommended for winter legumes on the more productive fine sandy loam soils in eastern Texas. On the lighter scils in this region the use of 200 to 300 pounds per acre of 0–14–7 may be more satisfactory.

Cowpeas, Soybeans, and Crotalaria

Where these crops are grown in eastern Texas in rotation with other crops that are fertilized, as cotton, corn, tomatoes, or potatoes, they are usually not fertilized. When grown on soil that has not been fertilized in three or four years the use of 100 to 200 pounds per acre of 20 per cent superphosphate or its equivalent or 200 pounds of 0–14–7 may be tried.

Pastures

For eastern Texas, the Gulf Coast Prairie, and irrigated pastures of South Texas the use of 200 to 400 pounds of 20 per cent superphosphate or its equivalent is recommended. The use of 200–300 pounds of 0–14–7 may be tried on the lighter soils in the eastern part of the state.

Small Grains

Wheat, oats, and barley for grain are grown mainly on the dark calcareous soils in north central Texas, where fertilizers have not been profitable on these crops, and in northwestern Texas, where moisture is the chief limiting factor in crop production. Consequently, fertilizers are not recommended for these crops in those regions. In the eastern part of the state, however, where oats are grown on the sandy soils for grazing and as a cover crop, the application of 100 to 200 pounds per acre of 0–14–7 or 100 to 150 pounds of superphosphate is suggested. Since oats also need nitrogen the mixing of 100 to 200 pounds of cottonseed meal or similar organic nitrogenous fertilizers or applied at a spearate application, is recommended.

Vegetables and Fruits

The grades 4–12–4, 4–10–7, and 4–8–12 can be used for vegetables and fruits, to a very limited extent, the 10–10–0 and 10–20–0. The 0–14–7, 3–15–0, and 3–12–6 can also be used for vegetables and fruits.

Of the formulas available, 4–12–4, seems in general, to be best and 4–10–7 second. Where not otherwise recommended, 300 to 600 pounds per acre of 4–12–4 or 4–10–7 may be used for fruits and vegetables, with the addition of 100 pounds per acre of nitrate of soda or 200 pounds of cottonseed meal if available.

Farm Income Increasing

Farm income in 1943 from marketings of farm products may total 15 to 20 per cent more than in 1942, according to the U. S. Department of Agriculture. Returns from nearly all types of products are likely to be higher in 1943 than in 1942, but present indications are that meat animals, poultry, oil-bearing crops, and vegetables are again likely to record the largest increases in income.

An Appraisal of Calcium and Potassium Metaphosphates as Sources of Phosphorous for Crop Plants

By B. E. BROWN and K. G. CLARK[1]

READERS are familiar with the respective research activities of the Tennessee Valley Authority and of the United States Department of Agriculture on the technical development of methods for the manufacture of phosphatic materials suitable for fertilizer use. The combined efforts of these two agencies have done much to advance our knowledge of the chemistry of phosphate rock and phosphates and to further the development and utilization of high-analysis phosphate fertilizers.

Calcium metaphosphate and potassium metaphosphate, two such materials, are of considerable interest for several reasons: (1) They have a very high plantfood content;[2] (2) their adaptability to the manufacture of high analysis fertilizers is of major interest; and (3) both permit significant reductions to be made in handling and transportation costs. It is obvious that either of these metaphosphates would carry much more phosphorus per unit of shipping capacity than 20 per cent superphosphate, and also that they possess potential value over other high-analysis phosphorus and potassium-bearing materials in this respect.

It is of much interest to note what P. Parrish, a British authority on fertilizer production and use, had to say on the subject of metaphosphates[3] shortly after the attack on Pearl Harbor. According to him, the spread of the war to the Far East further reduced and interfered with Great Britain's sources of supply of natural phosphate rock and other phosphatic materials. At that time, it was his opinion that this interference might become so acute that other sources and new forms of phosphates would have to be sought. In this connection Mr. Parrish stated: "It may well be that the use of metaphosphates of calcium and potassium will increase in the near future."

At the request of the Tennessee Valley Authority, the Bureau of Plant Industry undertook to evaluate calcium metaphosphate as a source of phosphorus for crop plants. At the time this particular request was made, the junior author was interested in having potassium metaphosphate similarly evaluated, so arrangements were made to conduct comparative tests with both metaphosphates. This was accomplished by means of both field[4] and greenhouse studies.

Results of greenhouse pot-culture studies, comparing the two metaphosphates with ordinary superphosphate as sources of phosphorus for millet (German and Hungarian), oats, and wheat when grown on different soil types—Caribou loam (Maine), Chester loam (Maryland), Norfolk loamy fine sand (Virginia), and Sassafras fine sandy loam (Virginia)—are reported herein.

Results of Other Greenhouse Pot Experiments

Jacob and Ross (*1*)[5] reported that calcium metaphosphate was approximately equal to superphosphate as a source of phosphorus for the growth of plants on acid and neutral soils, but results of a single series of tests indicated that this material is not so effective as either monocalcium phosphate or ordinary super-

[1] Senior biochemist, Division of Fruit and Vegetable Crops and Diseases, and Senior Chemist, Division of Soil and Fertilizer Investigations, respectively, Bureau of Plant Industry, Agricultural Research Administration, U. S. Department of Agriculture.

[2] Pure calcium metaphosphate contains 71.68 per cent P_2O_5; pure potassium metaphosphate, a double-nutrient compound, has a content of 60.13 per cent P_2O_5 and 39.87 per cent K_2O, totaling 100 per cent of nutrient constituents.

[3] Chemical Age (London), p. 20, January 10, 1942.

[4] Results of field experiments were presented recently in an article entitled, "Nutrient Value of Some New Phosphatic Materials Used on Potatoes," by G. V. C. Houghland, K. G. Clark, Arthur Hawkins, and John C. Campbell, AMERICAN FERTILIZER 97 (7) 5–8, 1942.

[5] Numbers in parentheses refer to literature citations given at the close of the article.

phosphate on soils possessing an alkaline reaction.

McGeorge (*2*), using the Neubauer method and greenhouse pot tests, found that the phosphorus of calcium metaphosphate was nearly as available as that of triple superphosphate or monoammonium phosphate. In summarizing the data he states: "All the water-soluble phosphates, ortho, meta, and pyro, are excellent sources of phosphate as plant food for phosphate-deficient alkaline calcareous soils."

Hinkle (*3*), on the other hand, reported that annual yellow clover failed to produce as much dry weight or to absorb as much phosphorus from calcium metaphosphate as it did from Ammophos or triple superphosphate. He employed Gila clay, an alkaline calcareous soil, in the greenho—se study.

Karraker, *et al* (*4*), reporting on greenhouse tests with different phosphates, state that calcium metaphosphate was practically equivalent to superphosphate as a source of phosphorus for alfalfa, corn, and white clover.

Gilbert and Pember (*5*) obtained poor results with calcium metaphosphate, but this was, no doubt, due to the fact that the sample[6] they tested was nearly insoluble in neutral ammonium citrate solution, indicating a low phosphorus availability, which was confirmed by their pot tests.

In reference to potassium metaphosphate, available evidence from greenhouse and field experiments shows it to be an excellent source of phosphorus for crop plants. Jacob and Ross (*1*) cite a number of publications, chiefly foreign, which give results obtained with potassium metaphosphate.

Gilbert and Pember (*5*), comparing potassium metaphosphate with monocalcium phosphate, reported a clover growth rating of 106 for the former against 100 for the standard; for millet, an unusually high rating of 142 was obtained for potassium metaphosphate against 100 for monocalcium phosphate.

Description of Phosphatic Materials Used

The calcium metaphosphate used in the present greenhouse study was produced by the Tennessee Valley Authority by burning phosphorus in air and bringing the hot products of combustion into contact with rock phosphate at 1200 degrees C., and quickly cooling the molten product. Over a fairly long period of operation the material is reported to have averaged 65.5 per cent P O . The sample of calcium metaphosphate furnished for the greenhouse tests contained 63.87 per cent P_2O_5 and was almost completely soluble in neutral ammonium citrate solution.

The potassium metaphosphate sample was prepared by dehydration of primary potassium orthophosphate under suitable temperature conditions, the bulk of the combined water going off below 300 degrees C., but to insure complete dehydration heating was continued at 600 degrees C. The sample used in the greenhouse studies contained approximately 60 per cent phosphoric acid (P_2O_5) and 40 per cent potash (K_2O). This compound, like calcium metaphosphate, is almost insoluble in cold distilled water, but hydrolyzes slowly to potassium orthophosphate in warm water. A sample of 2.5 grams completely dissolves in half an hour in the boiling ammonium oxalate solution prescribed by the Association of Official Agricultural Chemists for the determination of available potash in mixed fertilizers.

Experimental Procedure

The greenhouse studies,[7] comparing the two metaphosphates with ordinary superphosphate as the standard phosphatic material, were conducted in one-gallon glazed pots holding five kg. of soil. The soil types used were (a) Caribou loam, pH 4.6; (b) Chester loam, pH 6.5; (c) Norfolk loamy fine sand, pH 5.5; (d) Sassafras fine sandy loam, pH 5.6. The basal fertilizer treatment was a 5–12–8 mixture applied at the rate of 2,000 pounds per acre in all tests[8]. The nitrogen in the nutrient mixtures was derived equally from three sources: sodium nitrate, ammonium sulphate, and cottonseed meal. The potash was derived from high-grade manure salts, which also supplied some magnesium; also from potassium metaphosphate supplemented with kieserite to supply magnesium in the same amount as the manure salts.[9] Phosphorus was derived from one of the metaphosphates or from ordinary superphosphate so as to furnish equal amounts of P_2O_5. One

[6] Not similar to the calcium metaphosphate sample furnished by the Tennessee Valley Authority for the present study, which was almost completely soluble in neutral ammonium citrate solution.

[7] Acknowledgment is due Fred. R. Reid, now with Division of Plant Exploration and Introduction, Bureau of Plant Industry, for supervising cultural details essential to the greenhouse studies.

[8] The mixture containing superphosphate, owing to an "over-run," was applied at the rate of 2,750 pounds per acre. However, the quantity of nutrients applied (N, P_2O_5, and K_2O) was the same in all cases, namely, 100pounds of N, 240 pounds of P_2O_5, and 160 pounds of K_2O per acre.

[9] At the rate of 38 pounds MgO per acre.

(Continued on page 24)

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Neutralizing Acid-Forming Fertilizers with Dolomite

The Georgia Agricultural Experiment Station has published Bulletin No. 223, giving the results of several years' experiments in determining the effect of neutralizing acid-forming fertilizers with dolomite on the response of cotton to different ratios of potash. The Bulletin was prepared by J. G. Futral of the Georgia Agricultural Experiment Station and J. J. Skinner of the Bureau of Plant Industry, U.S.D.A. A summary of the experimental results is as follows:

Experiments reported were initiated in 1937 to determine the relative efficiency on cotton of acid-forming and non acid-forming fertilizers and whether or not neutralizing fertilizers with dolomitic limestone affects the crop response to potash. In these experiments, nitrogen and phosphoric acid were applied to all plots at the rate of 36 pounds of nitrogen and 48 pounds of phosphoric acid per acre. Potash varied from 0 to 54 pounds per acre. One series of fertilizers was acid-forming, having an equivalent acidity of 500 pounds of calcium carbonate per ton. A corresponding series was made neutral by the addition of dolomitic limestone. The experiments were conducted on seven soil types used extensively for cotton in Georgia.

Non acid-forming fertilizers, containing dolomitic limestone, gave larger yields of cotton than acid-forming fertilizers in experiments on Cecil fine sandy loam, Clarkesville gravelly loam, Norfolk sandy loam, and Appling sandy loam. There was only a minor increase in yield from non acid-forming fertilizers over acid-forming on Orangeburg sandy loam, Tifton sandy loam, and Greenville sandy loam. Neutralizing acid-forming fertilizers with dolomitic limestone produced essentially the same increase in yield, regardless of the potash content of the fertilizer.

There was no appreciable response of cotton to applied potash on Cecil or Appling soils. The soils of these experiments contained relatively high amounts of available potash. There was a profitable increase in yield of cotton from potash on Clarksville, Norfolk, Orangeburg, Tifton and Greenville soils. Eighteen pounds of potash per acre gave significantly higher yields than no-potash. In acid-forming fertilizers the profit from 18 pounds of potash was about as great as from larger amounts. In non acid-forming fertilizers the greatest profit was from 36 pounds of potash per acre.

The average yield of cotton from 18, 36, and 54 pounds of potash per acre in these

experiments did not differ significantly in non acid-forming fertilizers, formulated with dolomitic limestone, and in acid-forming fertilizers. There was an insignificant trend for a higher response to potash in non acid-forming fertilizers than in acid-forming fertilizers and the profit from potash used on cotton was higher in non acid-forming fertilizers. However these data as a whole indicate that neutralizing acid-forming fertilizers with dolomitic limestone does not materially affect the crop's response or requirement for potash.

Order of Preference for Vegetablse

With the importance of fresh vegetables as a food underlined by the start of processed food rationing, farmers growing summer and fall vegetables for the fresh market are reminded by Secretary of Agriculture Claude R. Wickard of the acreage shifts sought by the Department to increase production of the more nutritive vegetables.

Substantial increases are desired for those crops which will contribute most to the nutritive adequacy of the nation's wartime diet. For other vegetables, which, although they add variety to the diet, contribute less nutritionally or involve disproportionate uses of labor or transportation, decreases in acreage are suggested. Department officials estimate that if these adjustments are made, the resulting production probably can be harvested, packaged and transported to market.

The Department of Agriculture will render the maximum assistance possible to obtain this result but wishes to emphasize again that the listing in the attached table establishes an order of preference. In the event that labor, packaging materials, fertilizers or transportation become so short that the needs of all crops cannot be satisfied, first preference will be given to those vegetables for which an increase in production is desired. Second preference will be extended to those vegetables for which production decreases are sought. So far, preferences of this nature have had to be applied only in a limited way, Department officials say. An example of this is the decision of the Department to restrict the application of fertilizer on certain vegetable crops in order to use the reduced supply of fertilizer most effectively.

It has been decided also that the Department would not be justified in paying for the transportation of labor for the specific purpose of harvesting such crops as lettuce. However, such labor could be so used if it is not required at that particular time for the production of a crop that has a higher order of preference.

The Department also will make every reasonable effort to recruit labor from local sources and to obtain farm help from areas not normally considered a source of agricultural labor for the harvesting of all crops, including all vegetables.

The following table shows the 1943 national acreage adjustments desired in commercial truck crops and the order of preference. These acreages do not include vegetables for processing or those included in market gardens.

COMMERCIAL TRUCK CROPS:
Suggested Acreages for Summer and Fall Harvest, With Comparisons.

Commodity	Suggested Acreage 1943	Percentage 1943 of 1942
	ACRES	PERCENT
Carrots	16,400	135
Kale	1,100	122
Beans, snap	80,000	117
Beans, lima	7,200	115
Beets	3,600	112
Corn, sweet	50,000	112
Tomatoes	100,000	111
Cabbage	124,600	108
Onions	70,100	107
Spinach	24,500	102
Peas, green	38,000	101
Asparagus	44,330	100
Peppers, green	9,300	95
Cauliflower	14,000	88
Eggplant	1,200	86
Lettuce	51,900	86
Cantaloupes	35,000	85
Watermelons	48,000	84
Celery	15,000	78
Cucumbers	13,000	74
Total	747,230	102

Proposed North Carolina Changes

House Bill 505 proposes to exempt "nitrogen-potash top dressers" from the requirements of the present law as to a guarantee of insoluble nitrogen and to remove from the present law the requirement that the list of approved grades be a minimum of 35. The requirement that the maximum number on the list be fixed at 50 is retained. The bill also proposes to delete the word "not" from the provision of the present law, Section 23(d), which reads: "The Commissioner in his discretion may allow reasonable tolerances for short weight not due to loss through handling and transportation."

Statement by Food Production Administrator

The Fertilizer Division of the Food Production Administration has issued the following statement:

"Food Production Order No. 5 has now been in effect for approximately one month. On the whole, it has met with industry and farmer approval. Such misunderstandings, as have developed, are primarily due to misinterpretation of provisions relative to priority of "A" crops and the fact that many manufacturers have not made provision to meet the heavy demand for Victory Garden Fertilizer.

"Requirements for 'A' crops do have priority and fertilizer manufacturers are obligated to provide for them even without historical records. The policy should be somewhat along the following lines: Satisfy the entire requirements of the historic trade for 'A' crop fertilizers. It is not necessary, however, that a buyer have a purchase history in order to qualify. If a farmer places requirements with a fertilizer manufacturer or with one of his dealers or agents, in territory normally served by him, it is directed that he fill such requirements, without attempting to supply or reserve materials for use on 'B' crops. A manufacturer is especially obligated if a farmer has in either of the past two years purchased fertilizers from him for use on any crop. Once a manufacturer has provided 'A' crop requirements, he can proceed with such 'B' crops deliveries as his supply situation warrants. We do not mean to imply that 'A' and 'B' crop requirements may not be delivered simultaneously, but a manufacturer should deliver only that portion of 'B' crop requirements which his present and assured supply situation warrants. The same would hold true in the case of 'B' crops which may be planted before certain 'A' crops. We repeat the 'A' crops must have priority. Base operations and deliveries accordingly. Do not push 'B' crop requirements ahead and make full deliveries for them months ahead of need while denying 'A' crop requirements as some have possibly done.

"The Victory Garden grade is new and some manufacturers are learning now, for the first time, of the substantial demand for specialty fertilizers. We must recognize that the millions of Victory Gardens being planted create a new demand for fertilizers, which those manufacturers who maintain specialty departments are not wholly equipped to supply. All manufacturers should recognize their responsibility to help out in this program.

"Please read carefully paragraph (f) (3) of the Order. A farmer who purchases a regular grade for use on crops can use the same grade on his garden. If, however, he requires a special garden fertilizer, he must buy the Victory Garden grade. Note that the grade can now be formulated entirely with chemical nitrogen.

"OPA ceiling prices were based on original specifications for this grade and defined maximum, *not minimum prices*. Retail buyers should be limited to the purchase of nominal amounts, perhaps not exceeding 500 pounds, unless they fill out a purchase application. Then, too, the manufacturer should satisfy himself that it is being purchased only for use on Victory Gardens.

"The Victory Garden fertilizer is the only grade containing chemical nitrogen which can be put up in small packages, and that is one of the primary reasons for the establishment of this special grade. It need not be packaged in special bags. It will be acceptable for the 5, 10, 25, and even 50-pound bags to be packed in plain bags with a sticker label bearing the name 'Victory Garden Fertilizer, For Food Production Only,' plus guaranteed analysis 3–8–7. Labelling must in all cases comply with existing State Legislation."

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FERTILIZER MATERIALS MARKET

NEW YORK

Ammonia Liquor Released for Fertilizer Use. Organic Ammoniates Still as Scarce as Ever. Potash Supplies Ample but Allocation Expected Soon. Triple Superphosphate May Be Obtained for Domestic Use.

Exclusive Correspondence to "The American Fertilizer"

NEW YORK, FEBRUARY 23, 1943.

Chemical Nitrogen

With release of ammonia liquors, the urgency for inorganic ammonia has been relieved; in fact, in many cases, fertilizer manufacturers are wondering just what to do with the liquor released to them.

Organic Nitrogen

Organic nitrogen is still as scarce as ever and it is almost impossible for fertilizer manufacturers to obtain any considerable quantities in any form.

Potash

There is no change in this situation as far as quantities of potash are concerned but evidently due to some inequality in the distribution of the commodity during the past season, which was strongly called to the attention of Washington, this material will probably be placed under allocation before the end of this season. We cannot see the necessity of the allocation of potash in view of the fairly adequate supplies, but evidently this opinion is not held by the Department of Agriculture which department would take charge of the allocation under the new set-up.

Superphosphate

There is no change, all manufacturers producing to the utmost. Regarding triple superphosphate, the scarcity of this material for home use is being severely felt by many manufacturers, but no relief can be expected until the orders for delivery against Lend-Lease are completed. From all indications, it would appear that, unless there is some change, triple will be available for domestic manufacturers beginning the end of March, or early April.

BALTIMORE

Excess Demand for Mixed Fertilizers Expected. Organics Out of Fertilizer Market. Potash to be Allocated in Near Future.

Exclusive Correspondence to "The American Fertilizer"

BALTIMORE, FEBRUARY 23, 1943.

Fertilizer manufacturers are now getting ready to start shipping for the spring season and anticipate that there will be a demand in excess of supply, due to scarcity of mineral and organic ammoniates.

Ammoniates.—Both tankage and blood are still in good demand for feed, and as long as this situation prevails there is little chance of any important quantities of these organics coming on the market for fertilizer purposes at lower prices.

Nitrogenous Material.—The market is bare of offerings due to decreased production and there is hardly likely to be any improvement in this situation as the season advances.

Vegetable Meals.—Both soya bean and cottonseed meals are barred from use in mixed fertilizer, for which reason no interest is being shown in these materials, and prices take them out of the class of fertilizer.

Sulphate of Ammonia.—There is no change in the situation and while allocations have been somewhat more liberal recently, deliveries have been far below manufacturers' requirements.

Nitrate of Soda.—It is reported that, in line with seasonal requirements, allocation of this material has been increased somewhat, but only for direct application to the soil.

Superphosphate.—There is no change in the situation and business is still being done on the basis of previously announced schedule, although manufacturers are not anxious

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- POTASH SALTS
- DRIED BLOOD
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to sell in view of the increased cost of manufacture, brought about by higher cost of freight and labor.

Potash.—The War Production Board has announced that potash for fertilizer purposes will be under allocation April 1st in order to provide equitable distribution among the farm trade.

Bone Meal.—The market continues unchanged with both raw and steamed bone meal practically unobtainable.

Bags.—There is no change in the bag situation, although second-hand cotton and burlap bags are still permissible for fertilizer purposes.

CHARLESTON

Relaxation of Fertilizer Ban on Cottonseed Meal Improves Situation Only Slightly. Other Fertilizer Organics Unobtainable.

Exclusive Correspondence to "The American Fertilizer"

CHARLESTON, FEBRUARY 23, 1943.

Even though fertilizer manufacturers are allowed to buy cottonseed meal from farmers for use as an organic in mixed goods, the fact that these mixtures can only be sold for citrus fruits, leaf tobacco, and Group A crops, coupled with the fact that there is practically very little meal obtainable, has meant that so far the fertilizer manufacturers have not received much relief on their organic problem.

Nitrogenous.—No further quantities have become available since our last report.

Castor Meal.—The supply of this material still demands far below the demand.

Dried Blood.—The situation on this material is unchanged. Unground, $5.38 per unit of ammonia ($6.53 per unit N) is going only to the feed trade.

Cottonseed Meal.—The eight per cent grade is quoted at $38.60, Atlanta, and soya meal at $44.75, but these quotations remain nominal.

CHICAGO

No Improvement in Fertilizer Organic Situation. Few Materials Immediately Available. Feed Demand Still Strong.

Exclusive Correspondence to "The American Fertilizer"

CHICAGO, FEBRUARY 22, 1943.

No improvement in supplies can be reported. Fertilizer manufacturers' appeals for organics have met with practically no response. There is none of the old-time "fertilizer tankage" obtainable, and nitrogeneous and sludge tankages are well booked for March and part of April. Relief is only possible in vegetable meals, but that appears most dubious.

Supplies for the feed trade remain inadequate to meet the heavy demand.

Ceiling prices are therefore well maintained: High grade fertilizer tankage, $3.85 to $4.00 ($4.68 to $4.98½ per unit N) and 10 cents; standard grades crushed feeding tankage, $5.53 per unit ammonia ($6.72 per unit N); blood, $5.38 ($6.54 per unit N); dry rendered tankage, $1.21 per unit of protein, Chicago basis.

PHILADELPHIA

Many Inquiries for Ammoniates But No Supply. Allocation of Chemical Materials Satisfactory. More Potash From Russia Reported.

Exclusive Correspondence to "The American Fertilizer"

PHILADELPHIA, FEBRUARY 23, 1943.

The market in last couple of weeks has been featured by many inquiries for higher testing ammoniates, without uncovering any. Chemical materials, being allocated, seem to be getting a fair distribution among the fertilizer mixers.

Ammoniates.—Still scarce and very unlikely that any worthwhile tonnage will turn up, at least during this mixing season.

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Sulphate of Ammonia.—Further releases are being made to the mixers.

Nitrate of Soda.—Allocated only for direct application.

Superphosphate.—Still being sold at old prices, as ceiling has not been established.

Bone Meal.—Demand good, but supply is not plentiful, although odd lots do turn up from time to time.

Potash.—Additional supplies of muriate have been reported as arriving from Russia.

TENNESSEE PHOSPHATE

Shipments Continue in Large Volume. Rock Prospecting Now Including Higher Priced Farm Lands. Labor Situation More Serious.

Exclusive Correspondence to "The American Fertilizer"

COLUMBIA, TENN., January 23, 1943.

The weather of the past two weeks has included some quite cold weather with heavy freezes, but in the main has been as it is at present, beautiful and springlike.

Shipments in all lines of phosphates to consuming channels are proceeding with greatest possible rapidity, at about the same rate as 1942 at same period, and with every effort to increase production in readiness for the seasonally increased demand following the open weather conditions soon to come in consuming areas.

The largest sale of ground rock for direct application to the soil to one farm operator was made last week when the owners of 7,000 acres in Northern Illinois bought five thousand tons to be shipped as fast as possible.

Considerable prospecting has been under way along the highway between Columbia and Mt. Pleasant in some of the very high-priced farming lands there which have heretofore been too high in farm value to tempt purchasers for mining values. The rapidly diminishing reserves in the main field at Mt. Pleasant may yet extend the mining area into the high-priced farms, and, of course, where underlaid with significant deposits, the question of farm value becomes immaterial.

Practically all this area has been left out of consideration in the past, not only for the above reasons, but because no deposits of the easily hand-mined lump rock occur to tempt the small hand miner who has nearly always been the predecessor of the large mining firms.

An item of significant interest is an advertisement in local papers for strong healthy colored women to "do a man's work and get a man's pay" to replace men called into the service. The work in question is railroad track construction, but labor in the mines and around the plants may before long be carried on to some extent by women, making the cook and maid problem more serious than ever.

Southern New England Fertilizer Conference

The Southern New England Fertilizer Conference held at Springfield, Mass., February 16th and 17th was attended by 112 persons, including about 20 agronomists and other agricultural workers from the New England States. Considering transportation and weather difficulties, attendance was excelment, as large in fact, as when the conference was held in Amherst. Director F. J. Sievers, Massachusetts Experiment Station, presided in his customary efficient and interesting manner. A. W. Manchester, director, Northeast Division, AAA, discussed "The 1943 Crop Goals for New England," emphasizing especially the great need for an increased production of potatoes. Dr. F. W. Parker, chief of soil and fertilizer investigations, U. S. D. A., spoke on "Fertilizers in New England's Wartime Agricultural Production Program." He stated that agronomists under the leadership of the Committee on Ferti-

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lizers of the American Society of Agronomy are now giving serious consideration to the selection of grades of fertilizers to be sold in 1943–44 and that preliminary conferences will be held in the near future in each area, the New England conference having been held on the previous day. The agronomists will proceed for the present on the assumption that supplies of all plant foods for next season will be adequate, and if it becomes apparent later that there will be shortages, appropriate adjustments in their recommendations will be made. Joint conferences with industry will be held in each region later. George M. Worman, field service representative, Fertilizer Section, Food Production Administration, spoke on "Food Production Order 5 as it Applies to New England," giving a number of recent interpretations that have been made in Washington. M. H. Lockwood, Eastern States Farmers' Exchange and a member of the Fertilizer Industry Advisory Committee, led the discussion and called on a number of producers to discuss specific provisions of the order. Those who took part in the discussion were E. S. Russell, R. E. Fraser, Charles Smith, L. E. Britton, Evan H. Jones, Merle Whipple, Raymond Clapp, A. F. Kingsbury, and R. A. Waite.

E. S. Russell, Old Deerfield Fertilizer Company, member of SIC and of the Board of Directors of the National Fertilizer Association, presided at the evening session. Charles J. Brand spoke on "South American Agriculture," illustrating his talk with many lantern slides taken on his recent trip. The session closed with a showing of "The Life of the Soil."

Wednesday morning, Roland Payne of OPA spoke briefly on "Fertilizer Pricing Under OPA" and answered a number of questions. Dr. J. A. Chucka presented a tentative list of ratios and minimum grades which had been selected by the agronomists for 1944. The suggested list was also discussed briefly by Prof. R. W. Donaldson, Massachusetts; Dr. A. R. Midgley, Vermont; Prof. Charles Moran, Rhode Island; Prof. J. S. Owens, Connecticut; and Prof. Ford S. Prince, New Hampshire. Dr. Chucka stated that suggestions made at the meeting would be given further consideration and that a joint conference of industry representatives and agronomists would be held before making final recommendation to U. S. D. A.

William F. Watkins, Fertilizer Section, FPA, attended the meeting and answered many questions that were raised concerning the provisions of FPO 5.

Agronomists representing the six New England States met at Springfield on February 15th and tentatively selected a master list of 15 ratios and minimum grades for all New England. These ratios and grades were discussed at the fertilizer conference on February 17th. If Food Production Order 5 is continued in effect for the 1943–44 fertilizer year, the list of grades for the several States will be revised in accordance with the joint recommendations of agronomists and members of the industry.

Scope of U. S. Bureau of Plant Industry Enlarged

Major changes in two bureaus of the Agricultural Research Administration were announced by the Department of Agriculture on February 23rd.

Agricultural engineering research, and also the research on chemical weed eradication and effluent contaminants, are transferred from the Bureau of Agricultural Chemistry and Engineering to the Bureau of Plant Industry. The latter will hereafter be known as the Bureau of Plant Industry, Soils, and Agricultural Engineering.

The direction of the four Regional Research Laboratories is transferred to the Bureau of Agricultural Chemistry and Engineering, which will hereafter be known as the Bureau of Agricultural and Industrial Chemistry.

These changes, Research Administrator E. C. Auchter explained, have been made to bring about a closer integration of related work.

"Practically all of the soils' research of the original Bureau of Soils, including soil chemistry, soil physics, soil fertility and genesis, and soil survey, as well as the fertilizer investigations of the old Fixed Nitrogen Laboratory, have been in the Bureau of Plant In-

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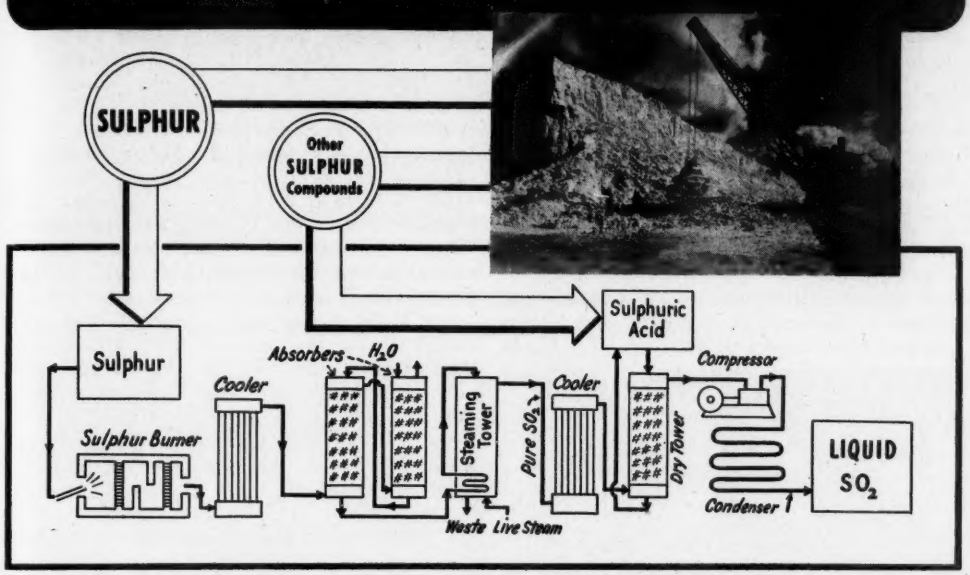

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dustry for some time," Dr. Auchter said. "The new title of the bureau recognizes that fact.

"Much of the research in agricultural engineering deals with machinery for handling the soil, placing fertilizers, planting, spraying, harvesting, storing, and performing other operations directly connected with soils and crops. This work is closely related to plant and soils research. The transfer making possible a more unified and comprehensive attack on problems by plant and soil scientists and agricultural engineers is important at this time, when the best possible research and advice must be available to the agencies in the Department concerned with producing food for civilians, the armed forces, and our allies.

"Integrating the four Regional Research Laboratories in a Bureau of Agricultural and Industrial Chemistry will greatly strengthen that important aspect of our research. These laboratories, which are already becoming famous for their work on the industrial utilization of farm crops in connection with the war, have a great future ahead of them."

INTERVIEW ON MR. BRAND'S SOUTH AMERICAN TRIP

(Continued from page 6)

stresses, "are among the greatest barriers to that understanding upon which the good neighbor spirit must depend."

He also strongly feels that at the earliest possible time lower transportation costs should be worked out between the Americas, in order to facilitate a two-way interchange of travel between these two great western continents. Pan-American-Grace Airways, Inc., and the domestic air services are already making a great contribution in this respect.

Mr. Brand emphasized, above all, that good neighborliness is of the essence of that elusive thing called the spirit. If we do not capture that and enlist it in our service in Latin America, we shall fail in the end to achieve a fine purpose.

Mr. Brand expressed especial indebtedness to Messrs. Jorge Vidal, vice-president; Florencio Garcia, general director; Harold Biggs, secretary; Fernando Mardones, sub-director general; Raul Aguirre Aguirre, research agronomist; and James Fyfe, Valparaiso manager, Corporacion de Ventas de Salitre y Yodo de Chile; to Horace R. Graham, vice-president and deputy chairman, and Paul F. Kruger, vice-president and administrator of producing operations for Lautaro Nitrate Company and Anglo-Chilean Nitrate Corporation; to Dr. Eduardo Cruz Coke, former Minister of Health of Chile; to Mr. Osvaldo F. de Castro, Compania Salitrera de Tarapaca y Antofagasta; to Mr. Henry La Motte, manager, Gildemeister & Company, Lima, Peru; to Hon. William L. Clayton, the Assistant Secretary of Commerce, Washington, and Messrs. Emmett Waddell and Horatio Pyle of Anderson, Clayton & Company's staff at Sao Paulo, Brazil; and to our consul general there, Cecil M. P. Cross, and his agricultural associate, H. W. Spielman, and to Mr. Harold Roig, top executive of Panagra air lines, and other enterprises of W. R. Grace & Company, and his associates.

Embassy staff members in each of the countries visited also helped greatly. This was particularly true of Erwin P. Keeler, agricultural attache at Rio de Janeiro, and his staff, and of Dr. Paul Nyhaus, agricultural attache at Buenos Aires, and his assistant, Mr. Don Stoops, who, with W. P. McCullough, commercial attache of the Canadian Legation, devoted two hard days of motor travel to showing Mr. Brand the agriculture of the province of Buenos Aires.

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AN APPRAISAL OF CALCIUM AND POTASSIUM METAPHOSPHATES AS SOURCES OF PHOSPHORUS FOR CROP PLANTS

(Continued from page 11)

series of pots, treated with the nitrogen and potash materials alone, served as the no-phosphorus control (5–0–8). The different fertilizer combinations were incorporated with the soil by means of a mechanical mixer. Each fertilizer treatment was run in triplicate, the final stand being 10 plants per pot or 30 plants per treatment.

Twelve separate pot-culture experiments were run with the four treatments indicated: Three each with German and Hungarian millet, two with wheat, and one with oats on Norfolk loamy fine sand; and one each with German millet on Caribou loam, Chester loam, and Sassafras fine sandy loam. The plant growths[10] obtained are reported in Tables I and II on a moisture-free basis.

Discussion of Results

An examination of the results discloses that a definite response to phosphate fertilization was obtained in all cases. Only small yield differences, however, were observed between the different phosphate treatments, there being no apparent correlation between soil reaction and the relative availability of the different forms of phosphorus over the pH range of 4.6 to 6.5.

Although the individual yield variations were not very marked, calcium metaphosphate

[10] Heading stage.

TABLE I.

RESULTS WITH OATS, WHEAT, AND MILLET IN COMPARING CALCIUM AND POTASSIUM METAPHOSPHATES WITH SUPERPHOSPHATE

Soil Type: Norfolk Loamy Fine Sand.

Sources of phosphorus in 5–12–8 mixture	Actual and relative weights of test crops(*a*), moisture-free basis. Oats(*b*)		Wheat(*c*)		Hungarian Millet (*d*)		German Millet(*e*)	
	Actual	Relative	Actual	Relative	Actual	Relative	Actual	Relative
	Grams	Per cent	Grams	Per cent	Grams	Per cent	Grams	Per cent
Ordinary superphosphate....	28.0	100	53.4	100	108.1	100	139.4	100
Calcium metaphosphate.....	29.4	105	56.3	105.4	104.0	96.2	141	101.4
Potassium metaphoshpate...	30.6	109	56.0	105	105.4	97.6	132.6	95.1
N–K only (5–0–8).....	14.0	50	24.2	45.1	75.6	70	45.6	32.7

(*a*) Thirty plants. (*b*) One test. (*c*) Two tests combined, total yield. (*d*) Three tests combined, total yield. (*e*) Three tests combined, total yield.

TABLE II

RESULTS WITH MILLET (GERMAN) COMPARING CALCIUM AND POTASSIUM METAPHOSPHATES WITH SUPERPHOSPHATE ON DIFFERENT SOILS

Source of phosphorus in 5-12-8 Mixture	Actual and relative weights of millet test crop,(*a*) moisture-free basis. Caribou loam pH 4.6		Chester loam pH 6.5		Norfolk l.f.s.(*b*) pH 5.5		Sassafras f.s.l. pH 5.6	
	Actual	Relative	Actual	Relative	Actual	Relative	Actual	Relative
	Grams	Per cent	Grams	Per cent	Grams	Per cent	Grams	Per cent
Superphosphate.....	72.6	100	50.2	100	55.4	100	63.5	100
Calcium metaphosphate.....	68.0	93.7	53.5	106.6	54.9	99.1	66.0	104
Potassium metaphosphate...	68.5	94.3	56.2	112.0	52.7	95.1	66.3	104.4
N–K only (5–0–8	54.8	75.5	32.0	63.7	31.3	56.5	54.7	86.1

(*a*) Thirty plants per treatment (three pots, 10 plants each). (*b*) Also included in Table I with Norfolk soil results.

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Information and references available on request.

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See Page 4

gave a higher yield than superphosphate in seven of the twelve tests, and potassium metaphosphate in six.

Neither of the metaphosphates gave any indication of injurious effects, and both proved to be just as satisfactory as superphosphate as phosphorus sources.

Summary

Calcium metaphosphate and potassium metaphosphate, two comparatively new phosphatic materials of considerable interest, have been proposed for fertilizer use. Twelve greenhouse pot-culture experiments were run to evaluate these metaphosphates as phosphorus sources in mixed fertilizer for millet (German and Hungarian), oats, and wheat, in comparison with ordinary superphosphate as the standard source of phosphorus. The crop plants were grown on four different soils —Caribou loam, pH 4.6; Chester loam, pH 6.5; Norfolk loamy fine sand, pH 5.5; and Sassafras fine sandy loam, pH 5.6.

Calcium metaphosphate gave a higher yield than superphosphate in seven of the twelve tests, and in six the yield with potassium metaphosphate exceeded that with superphosphate. No indication of injurious effects was observed.

The total plant growth of all indicator crops throughout the experimental work amounted to 515.2 grams for the superphosphate mixture, 518.2 grams for the calcium metaphosphate, and 515.6 grams for the potassium metaphosphate (300.9 grams for the no-phosphorus mixture). These closely agreeing results are in general harmony with those obtained by other investigators who have run greenhouse pot-culture tests on calcium and potassium metaphosphates.

Literature Cited

(*1*) Jacob, K. D., and Ross, William H., "Nutrient Value of the Phosphorus in Defluorinated Phosphate, Calcium Metaphosphate, and Other Phosphatic Materials as Determined by Growth of Plants in Pot Experiments," Jour. Agr. Research 61:539–560, 1940.

(*2*) McGeorge, W. T., "Factors Influencing the Availability of Native Soil Phosphates and Phosphate Fertilizers in Arizona Soils," Arizona Agr. Expt. Sta. Tech. Bull. 82, 1939.

(*3*) Hinkle, D. A., "Efficiency of Various Phosphate Fertilizers on Calcareous Soil for Alfalfa and Sweet Clover," Jour. Amer. Soc. Agron. 34:913–918, 1942.

(*4*) Karraker, P. E., Miller, Harold F., Bortner, C. E., and Todd, Jack R., "Greenhouse Tests of the Availability of Phosphorus in Certain Phosphate Fertilizers," Kentucky Agr. Expt. Sta. Bull. 413, 1941.

(*5*) Gilbert, Basil E., and Pember, Frederick R., "A Study of the Availability of Ammoniated Superphosphate and Various Unusual Phosphatic Carriers by Means of Vegetative Pot Tests," Rhode Island Agr. Expt. Sta. Bull. 256, 1936.

Woodward & Dickerson Move Offices

Woodward & Dickerson, well-known Philadelphia firm of brokers and importers in fertilizer materials and chemicals, have moved their offices from 16 N. Front Street to the Girard Trust Company, 1400 S. Penn Square. The management of the concern will continue under the direction of H. A. C. Rauchfuss, proprietor.

McCarty Returns to Ashcraft-Wilkinson

George W. McCarty, who more than a year ago was given a leave of absence by his Company to serve the Government as assistant chief of the Nitrogen Unit, War Production Board, is returning to Atlanta to resume his former position as Senior Vice-President of Ashcraft-Wilkinson Company. During the past year he has been able to render valuable service to the Government and he will continue to act in advisory capacity as a Consultant to the Nitrogen Unit.

Cottonseed Meal Output Increasing

The U. S. Bureau of the Census reports an increase in cottonseed crushed during the period from August 1, 1942 to January 31, 1943 over the similar period of the previous crop year. The 1942–43 crush was 3,255,402 tons, compared with 2,761,987 tons in 1941–42. Production of cake and meal increased from 1,206,799 during this 6-month period of 1941–42 to 1,440,003 tons in 1942–43. Shipments showed an even larger rise, from 1,001,509 tons in 1941–42 to 1,554,237 tons in 1942–43. This is reflected in the stocks on hand, which on January 31, 1943 amounted to only 75,866 tons.

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This list contains representative concerns in the Commercial Fertilizer Industry, Including fertilizer manufacturers, machinery and equipment manufacturers, dealers in and manufacturers of commercial fertilizer materials and supplies, brokers, chemists, etc.
For Alphabetical List of Advertisers, see page 33.

ACID BRICK
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Chemical Construction Corp., New York City.

ACID EGGS
Chemical Construction Corp., New York City.

ACIDULATING UNITS
Chemical Construction Corp., New York City.
Sackett & Sons Co., The A. J., Baltimore, Md.

AMMO-PHOS
American Cyanamid Co., New York City.

AMMONIA—Anhydrous
Barrett Division, The, Allied Chemical & Dye Corp., New York City.
DuPont de Nemours & Co., E. I., Wilmington, Del.
Hydrocarbon Products Co., New York City.

AMMONIA LIQUOR
Barrett Division, The, Allied Chemical & Dye Corp., New York City.
DuPont de Nemours & Co., E. I., Wilmington, Del.
Hydrocarbon Products Co., New York City.

AMMONIA OXIDATION UNITS
Chemical Construction Corp., New York City.

AMMONIATING EQUIPMENT
Sackett & Sons Co., The A. J., Baltimore, Md.

AMMONIUM NITRATE SOLUTIONS
Barrett Division, The, Allied Chemical & Dye Corp., New York City.

AUTOMATIC ELEVATOR TAKEUPS
Sackett & Sons Co., The A. J., Baltimore, Md.

BABBITT
Sackett & Sons Co., The A. J., Baltimore, Md.

BAGS AND BAGGING—Manufacturers
Bagpak, Inc., New York City.
Bemis Bro. Bag Co., St. Louis, Mo.
St. Regis Paper Co., New York City.
Textile Bag Mfrs. Association, Chicago, Ill.
Union Bag & Paper Corporation, New York City.

BAGS—Cotton
Bemis Bro. Bag Co., St. Louis, Mo.
Textile Bag Mfrs. Association, Chicago, Ill.

BAGS—Paper
Bagpak, Inc., New York City
Bemis Bro. Bag Co., St. Louis, Mo.
St. Regis Paper Co., New York City.
Union Bag & Paper Corporation, New York City.

BAGS (Waterproof)—Manufacturers
Bemis Bro. Bag Co., St. Louis, Mo.
St. Regis Paper Co., New York City.
Textile Bag Mfrs. Association, Chicago, Ill.
Union Bag & Paper Corporation, New York City.

BAGS—Dealers and Brokers
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Huber & Company, New York City.
Jett, Joseph C., Norfolk, Va.
McIver & Son, Alex. M., Charleston, S. C.
Wellmann, William E., Baltimore, Md.

BAG CLOSING MACHINES
Bagpak Inc., New York City.

BAGGING MACHINES—For Filling Sacks
Atlanta Utility Works, East Point, Ga.
Bagpak, Inc., New York City.
Sackett & Sons Co., The A. J., Baltimore, Md.

BAG PILERS
Link-Belt Company, Philadelphia, Chicago.

BEARINGS
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

BELT LACING
Sackett & Sons Co., The A. J., Baltimore, Md.

BELTING—Chain
Atlanta Utility Works, East Point, Ga.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

BELTING—Leather, Rubber, Canvas
Sackett & Sons Co., The A. J., Baltimore, Md.

BOILERS—Steam
Atlanta Utility Works, East Point, Ga.

BONE BLACK
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Huber & Company, New York City.

BONE PRODUCTS
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
Jett, Joseph C., Norfolk, Va.
McIver & Son, Alex. M., Charleston, S. C.
Schmaltz, Jos. H., Chicago, Ill.
Wellmann, William E., Baltimore, Md.

BORAX AND BORIC ACID
American Potash and Chem. Corp., New York City.
Pacific Coast Borax Co., New York City.

BROKERS
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Dickerson Co., The, Philadelphia, Pa.
Huber & Company, New York City.
Jett, Joseph C., Norfolk, Va.
Keim, Samuel L., Philadelphia, Pa.
McIver & Son, Alex. M., Charleston, S. C.
Schmaltz, Jos. H., Chicago, Ill.
Wellmann, William E., Baltimore, Md.

BUCKETS—Elevator
Link-Belt Company, Philadelphia, Chicago
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

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BUYERS' GUIDE

For an Alphabetical List of all the Advertisers, see page 33

BUCKETS—For Hoists, Cranes, etc., Clam Shell, Orange Peel, Drag Line, Special; Electrically Operated and Multi Power
Hayward Company, The, New York City.
Link-Belt Company, Philadelphia, Chicago.

BURNERS—Sulphur
Chemical Construction Corp., New York City.

BURNERS—Oil
Monarch Mfg. Works, Inc., Philadelphia, Pa.
Sackett & Sons Co., The A. J., Baltimore, Md.

CABLEWAYS
Hayward Company, The, New York City.

CARBONATE OF AMMONIA
American Agricultural Chemical Co., New York City.
DuPont de Nemours & Co., E. I., Wilmington, Del.

CARS—For Moving Materials
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CARTS—Fertilizer, Standard and Roller Bearing
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.

CASTINGS—Acid Resisting
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Duriron Co., Inc., The, Dayton, Ohio.

CASTINGS—Iron and Steel
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CEMENT—Acid-Proof
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Chemical Construction Corp., New York City.

CHAIN DRIVES—Silent
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CHAINS AND SPROCKETS
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CHAMBERS—Acid
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.

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Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Duriron Co., Inc., The, Dayton, Ohio.
Monarch Mfg. Works, Inc., Philadelphia, Pa.

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American Cyanamid Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
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Baker & Bro., H. J., New York City.
Barrett Division, The, Allied Chemical & Dye Corp., New York City.
Bradley & Baker, New York City.
DuPont de Nemours & Co., E. I., Wilmington, Del.
Huber & Company, New York City.

CHEMICALS—Continued
International Minerals & Chemical Corporation, Chicago, Ill
McIver & Son, Alex. M., Charleston, S. C.
Phosphate Mining Co., The, New York City.
Wellmann, William E., Baltimore, Md.

CHEMICAL PLANT CONSTRUCTION
Atlanta Utility Works, East Point, Ga.
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
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CLUTCHES
Link-Belt Company, Philadelphia, Chicago.
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Stedman's Foundry and Mach. Works, Aurora, Ind.

CONCENTRATORS—Sulphuric Acid
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.

CONDITIONERS AND FILLERS
American Limestone Co., Knoxville, Tenn.
Dickerson Co., The, Philadelphia, Pa.
Phosphate Mining Co., The, New York City.

CONTACT ACID PLANTS
Chemical Construction Corp., New York City.

COPPER SULPHATE
Tennessee Corporation, Atlanta, Ga.

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Bradley & Baker, New York City.
Huber & Company, New York City
Jett, Joseph C., Norfolk, Va.
McIver & Son, Alex. M., Charleston, S. C.
Schmaltz, Jos. H., Chicago, Ill.
Wellmann, William E., Baltimore, Md.

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Hayward Company, The, New York City.
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Jett, Joseph C., Norfolk, Va.
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DENS—Superphosphate
Chemical Construction Corp., New York City.
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BUYERS' GUIDE

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Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

DRYERS—Direct Heat
Sackett & Sons Co., The A. J., Baltimore, Md.

DRIVES—Electric
Link-Belt Company, Philadelphia, Chicago.

DUMP CARS
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

DUST COLLECTING SYSTEMS
Sackett & Sons Co., The A. J., Baltimore, Md.

ELECTRIC MOTORS AND APPLIANCES
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.

ELEVATORS
Atlanta Utility Works, East Point, Ga.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

ELEVATORS AND CONVEYORS—Portable
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

ENGINEERS—Chemical and Industrial
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

ENGINES—Steam
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.

EXCAVATORS AND DREDGES—Drag Line and Cableway
Hayward Company, The, New York City.
Link-Belt Company, Philadelphia, Chicago.
Link Belt Speeder Corp., Chicago, Ill., and Cedar Rapids, Iowa.

FERTILIZER MANUFACTURERS
American Agricultural Chemical Co., New York City.
American Cyanamid Company, New York City.
Armour Fertilizer Works, Atlanta, Ga.
Farmers Fertilizer Company, Columbus, Ohio.
International Minerals and Chemical Corporation, Chicago, Ill.
Phosphate Mining Co., The, New York City.
U. S. Phosphoric Products Division, Tennessee Corp., Tampa, Fla.

FISH SCRAP AND OIL
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
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McIver & Son, Alex. M., Charleston, S. C.
Wellmann, William E., Baltimore, Md.

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Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

GARBAGE TANKAGE
Wellmann, William E., Baltimore, Md.

GEARS—Machine Moulded and Cut
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

GEARS—Silent
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

GELATINE AND GLUE
American Agricultural Chemical Co., New York City.

GUANO
Baker & Bro., H. J., New York City.

HOISTS—Electric, Floor and Cage Operated, Portable
Hayward Company, The, New York City.

HOPPERS
Atlanta Utility Works, East Point, Ga.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

IMPORTERS, EXPORTERS
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Wellmann, William E., Baltimore, Md.

IRON SULPHATE
Tennessee Corporation, Atlanta, Ga.

INSECTICIDES
American Agricultural Chemical Co., New York City.

LACING—Belt
Sackett & Sons Co., The A. J., Baltimore, Md.

LIMESTONE
American Agricultural Chemical Co., New York City.
American Limestone Co., Knoxville, Tenn.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
McIver & Son, Alex. M., Charleston, S. C.
Wellmann, William E., Baltimore, Md.

LOADERS—Car and Wagon, for Fertilizers
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

MACHINERY—Acid Making
Atlanta Utility Works, East Point, Ga.
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Chemical Construction Corp., New York City.
Duriron Co., Inc., The, Dayton, Ohio.
Fairlie, Andrew M., Atlanta, Ga.
Monarch Mfg. Works, Inc., Philadelphia, Pa.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

MACHINERY—Coal and Ash Handling
Hayward Company, The, New York City.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

MACHINERY—Elevating and Conveying
Atlanta Utility Works, East Point, Ga.
Hayward Company, The, New York City.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

MACHINERY—Grinding and Pulverizing
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

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MAGNETS
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MANGANESE SULPHATE
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Tennessee Corporation, Atlanta, Ga.

MIXERS
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Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

NITRATE OF SODA
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Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Barrett Division, The, Allied Chemical & Dye Corp., New York City.
Bradley & Baker, New York City.
Chilean Nitrate Sales Corp., New York City.
Huber & Company, New York City.
International Minerals & Chemical Corporation, Chicago, Ill.
McIver & Son, Alex. M., Charleston, S. C.
Schmaltz, Jos. H., Chicago, Ill.
Wellmann, William E., Baltimore, Md.

NITRATE OVENS AND APPARATUS
Chemical Construction Corp., New York City.

NITROGEN SOLUTIONS
Barrett Division, The, Allied Chemical & Dye Corp., New York City.

NITROGENOUS ORGANIC MATERIAL
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
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Huber & Company, New York City.
International Minerals & Chemical Corporation, Chicago, Ill.
McIver & Son, Alex. M., Charleston, S. C.
Smith-Rowland Co., Norfolk, Va.
Wellmann, William E., Baltimore, Md.

NOZZLES—Spray
Monarch Mfg. Works, Philadelphia, Pa.

PACKING—For Acid Towers
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Chemical Construction Corp., New York City.

PANS AND POTS
Stedman's Foundry and Mach. Works, Aurora, Ind.

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Chemical Construction Corp., New York City.

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American Cyanamid Co., New York City
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McIver & Son, Alex. M., Charleston, S. C.
Phosphate Mining Co., The, New York City.
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Schmaltz, Jos. H., Chicago, Ill.
Southern Phosphate Corp., Baltimore, Md.
Virginia-Carolina Chemical Corp. (Mining Dept.), Richmond, Va.
Wellmann, William E., Baltimore, Md.

PIPE—Acid Resisting
Duriron Co., Inc., The, Dayton, Ohio.

PIPES—Chemical Stoneware
Chemical Construction Corp., New York City.

PIPES—Wooden
Stedman's Foundry and Mach. Works, Aurora, Ind.

PLANT CONSTRUCTION—Fertilizer and Acid
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.

POTASH SALTS—Dealers and Brokers
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
International Minerals & Chemical Corporation, Chicago, Ill.
Jett, Joseph C., Norfolk, Va.
Schmaltz, Jos. H., Chicago, Ill.
Wellmann, William E., Baltimore, Md.

POTASH SALTS—Manufacturers
American Potash and Chem. Corp., New York City.
Potash Co. of America, New York City.
International Minerals & Chemical Corp., Chicago, Ill.
United States Potash Co., New York City.

PULLEYS AND HANGERS
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

PUMPS—Acid-Resisting
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Duriron Co., Inc., The, Dayton, Ohio.
Monarch Mfg. Works, Inc., Philadelphia, Pa.

PYRITES—Brokers
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., New York City.
Wellmann, William E., Baltimore, Md.

QUARTZ
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.

RINGS—Sulphuric Acid Tower
Chemical Construction Corp., New York City.

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McIver & Son, Alex. M., Charleston, S. C.
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SHOVELS—Power
Link-Belt Company, Philadelphia, Chicago.
Link-Belt Speeder Corporation, Chicago, Ill., and Cedar Rapids, Iowa.
Sackett & Sons Co., The A. J., Baltimore, Md.

SPRAYS—Acid Chambers
Monarch Mfg. Works, Inc., Philadelphia, Pa.

SPROCKET WHEELS (See Chains and Sprockets)

STACKS
Sackett & Sons Co., The A. J., Baltimore, Md.

SULPHATE OF AMMONIA
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
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McIver & Son, Alex. M. Charleston, S. C.

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Ashcraft-Wilkinson Co., Atlanta, Ga.
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International Minerals & Chemical Corporation, Chicago, Ill.
Jett, Joseph C., Norfolk, Va.
McIver & Son, Alex. M., Charleston, S. C.
Schmaltz, Jos. H., Chicago, Ill.
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International Minerals & Chemical Corporation, Chicago, Ill
Phosphate Mining Co., The, New York City.
U. S. Phosphoric Products Division, Tennessee Corp., Tampa, Fla.

SYPHONS—For Acid
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TANKAGE
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Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
International Minerals & Chemical Corporation, Chicago, Ill.
Jett, Joseph C., Norfolk, Va.
McIver & Son, Alex. M., Charleston, S. C.
Schmaltz, Jos. H., Chicago, Ill.
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Wellmann, William E., Baltimore, Md.

TANKAGE—Garbage
Huber & Company, New York City.

TANKS
Sackett & Sons, Co., The A. J., Baltimore, Md.

TILE—Acid-Proof
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.

TOWERS—Acid and Absorption
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.

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UREA
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UREA-AMMONIA LIQUOR
DuPont de Nemours & Co., E. I., Wilmington, Del.

VALVES—Acid-Resisting
Atlanta Utility Works, East Point, Ga.
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
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Monarch Mfg. Works, Inc., Philadelphia, Pa.

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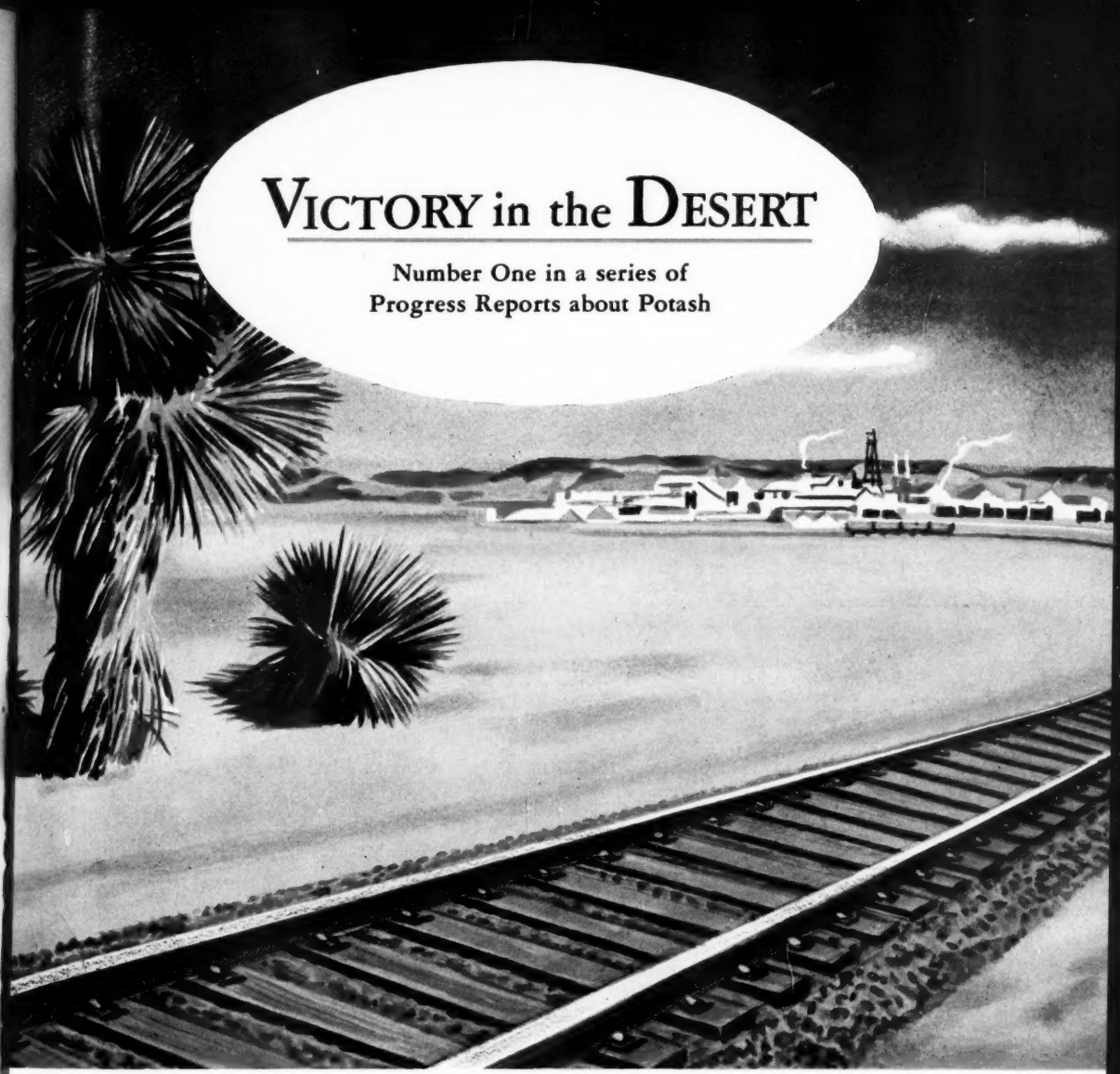

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